

Helsinki Institute for Information Technology HIIT Annual Report 2002

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1 HIIT in Brief

Helsinki Institute for Information Technology HIIT is a joint research institute of the two leading research universities in Helsinki, the University of Helsinki (UH) and the Helsinki University of Technology (HUT). HIIT was founded in 1999 and has been operational since early 2000.

HIIT conducts internationally high-level strategic research in information technology and related multi-disciplinary topics, especially in areas where the Finnish IT industry has or may reach a significant global role. HIIT works in close co-operation with Finnish universities, research institutes, and the industry, aiming to improve the contents, visibility, and impact of Finnish IT research to benefit the competitiveness and the progress of the Finnish information society. HIIT also aims at creating a strong network of international partnerships with leading foreign research universities and institutions.

HIIT is directed by a Board consisting of members from the universities, industry, and HIIT personnel. The Industrial Advisory Board manages the HIIT-industry liaison. The Scientific Advisory Board advises the Board on strategic planning of HIIT's research directions.

HIIT consists of two autonomous units. The Advanced Research Unit (ARU) mainly operates through two to three years long industry co-funded research projects. The present projects cover mobile and ubiquitous computing, user experience research, intelligent systems, digital media convergence, semantic computing, and digital economy. Professor Martti Mäntylä is the Research Director of the Advanced Research Unit.

The Basic Research Unit (BRU) focuses on long-term basic research issues in information technology, including challenges arising in major novel application areas in sciences and engineering. The present research groups work on data analysis and adaptive computing systems. Professor Heikki Mannila is the Research Director of the Basic Research Unit.

The Advanced Research Unit is located in the High Tech Center Helsinki in Ruoholahti, Helsinki. The Basic Research Unit is located at the premises of the Department of Computer Science of UH in Vallila, Helsinki, and the Department of Computer Science and Engineering of HUT in Otaniemi, Espoo.

2 Review of Year 2002

2.1 Advanced Research Unit (Professor Martti Mäntylä)

In the brief history of HIIT, 2002 was the first year that might be considered “normal” in that it was not marked by some drastic events that would have shaken the entire organisation to its foundations. In contrast, 1999 was the year of founding and laying out the basic framework of HIIT; 2000 the year of launching its research activities in the selected focus areas; and 2001 the year of rapid expansion and moving to the new premises at the High Tech Center Helsinki in Ruoholahti.

Yet 2002 was *far* from uneventful.

First and foremost, HIIT’s Basic Research Unit was successfully launched – as described below by Professor Heikki Mannila, its Research Director. This landmark event was obviously also reflected in HIIT’s already existing activities, now rechristened the Advanced Research Unit of HIIT. The resulting structure was formally defined in June 2002 when the new management bylaws of HIIT were ratified by the parent universities of HIIT, the University of Helsinki and the Helsinki University of Technology. With this, HIIT seems to have found its stable external form.

For ARU research activities, 2002 was a year of considerable expansion. While all four main research areas of ARU had been launched during 2000-2001, at the start of the year the list of research activities only contained eight projects continuing in 2002:

Fuego: Future Mobile and Ubiquitous Computing

Sarcous: Software Architectures for Configurable Ubiquitous Systems
Between: Ubicomp Bubbles Enhancing Human-Human and Human-Computer Interaction

Intelligent Systems

PAI: Personal Adaptive Interfaces
DeepC: Computationally Efficient Methods for Deep Computing (Academy of Finland)

Media Convergence

XML Devices: XML Capable User Devices

Digital Economy

Mobile IPR: Digital Rights Management on the Mobile Internet
STAMI: Security Technologies and User Attitudes in Mobile IPR
Legal Infrastructure of Location Services

By the end of the year, a similar list contained no less than seventeen projects, fourteen of which were to continue also in 2003 (for reference, the nine new projects launched during the year are shown in *italics*):

Fuego: Future Mobile and Ubiquitous Computing

Sarcous: Software Architectures for Configurable Ubiquitous Systems

Between: Ubicomp Bubbles Enhancing Human-Human and Human-Computer Interaction

EVIUS: European Virtual Testbed for Location-Sensitive Ubiquitous Services

Fuego Core: Mobile Internet Middleware

Context: Context Recognition by User Situation Data Analysis (Academy of Finland, jointly with BRU)

Intelligent Systems

PAI: Personal Adaptive Interfaces (-2002)

DeepC: Computationally Efficient Methods for Deep Computing

MINOS: Minimum Description Length Modeling in Computer Science and Statistics (Finnish Academy)

PRIMA: Proactive Information Retrieval by Adaptive Models of Users' Attention and Interests (Academy of Finland, jointly with HUT and HSE/CKIR)

Media Convergence

XML Devices: XML Capable User Devices

Semantic Web: Intelligent Directories

Digital Economy

Mobile IPR: Digital Rights Management on the Mobile Internet

STAMI: Security Technologies and User Attitudes in Mobile IPR

Legal Infrastructure of Location Services (-2002)

FITS: Digital Economy Issues in Transportation Telematics (Ministry of Transportation and Communications -2002)

The Welfare of Nations

DE Core: Structures of Mobile Digital Economy

Thus, perhaps excepting the Media Convergence research area, all research areas reached a “critical mass” size during 2002 – a strategic objective for HIIT from its very start. Another strategic objective neared its fulfilment with the establishment of “core projects” – root research activities that define and embody the longer-term objectives of the entire research area – both in the mobile computing and the digital economy research areas.

Of course, the expansion was also reflected in the human resources of the ARU. Two new research groups, the Mobile Computing Group led by Professor Kimmo Raatikainen, and the Semantic Computing Group led by Professor Eero Hyvönen, were established and became a part of HIIT’s fabric. With this, the number of researchers in ARU almost doubled to more than 70.

Importantly, the new HIITites included no less than five senior-level researchers: Dr. Wray Buntine, Dr. Pekka Himanen, Dr. Ken Rimey, Dr. Patrik Floréen, and Dr. Marko Turpeinen. Equally importantly, two of HIIT's "own" people reached a doctoral degree near the end of the year, and may thus join its senior ranks in the future: Dr. Jan Blom and Dr. Anu Kankainen. Thus, the expansion was not just in quantity, but also in quality.

It is also noteworthy that three of the new research activities launched during the year were funded by the Academy of Finland – and a fourth project to start in January 2003 was also accepted. This more than doubled the basic research funding available to ARU, obviously solidifying its scientific core. The great success that HIIT – both its units! – enjoyed in the Proactive Computing program of the Academy of Finland was particularly satisfactory.

Close co-operation with selected foreign research partners is another cornerstone of HIIT's strategy. For ARU, the University of California at Berkeley (UCB) had already been chosen as a prime partner, with one project firmly established at its School of Information Management and Systems (SIMS) already in 2000. During 2002, no less than three new projects in close co-operation with UCB were launched: DE Core with SIMS, Fuego Core with the Department of Electrical Engineering and Computer Science (EECS), and the Welfare of Nations with the International Computer Science Institute (ICSI). By the end of 2002, four HIIT researchers were working at UCB.

A major step in the co-operation with UCB was the establishment of the Berkeley Center for the Information Society (BCIS) at ICSI in September 2003. While BCIS is formally an independent organisation from HIIT, it will be directed by Dr. Pekka Himanen who also continues his work at HIIT as Senior Researcher in the Welfare of Nations project. Moreover, ARU's Research Director, Professor Martti Mäntylä is a member of the Scientific Board of BCIS. This "personal union" obviously puts HIIT in an attractive position to define and launch joint research activities with BCIS in the future.

During 2002, a first contact was also established with two other potential partners for similar deep and close co-operation. In October, a joint proposal for co-operation with the Tsinghua University in Beijing, China, was submitted for the Tenth Joint Session under the Scientific and Technological Co-operation Agreement between the People's Republic of China and the Republic of Finland. The proposal covers joint projects and researcher exchange. In November, it was accepted and put on the "priority list". While the implementation of the proposal will only be launched in 2003, the formal recognition of the co-operation was an important step to clear the obstacles for the co-operation.

Initial contact was also established with the Media Lab Europe in Dublin, aiming at a similar arrangement during 2003.

Up to 2002, HIIT and ARU had focused solely on domestically funded research activities. This was a deliberate choice: the combined experience of the senior researchers clearly suggested that international funding – notably funding from the framework programs of the European Union – requires a research organisation with sufficient maturity and critical mass.

By 2002, these preconditions were considered to have been satisfied, and preparation activities for EU projects were launched in both units of HIIT. This activity was greatly facilitated by Dr. Patrik Floréen, who formally joined the HIIT ranks in August 2002 as the Research Coordinator with joint appointment in ARU and BRU, and with the mission of facilitating especially EU-funded research activities.

Dr. Floréen's help – even before his formal appointment – allowed HIIT to submit six Expressions of Interest as a response to the EU call in June 2002, and especially to launch the more intensive preparation of research projects from August 2002 onwards. The fruits of this labour will only be seen during 2003 and later; still, the timely start of preparation activities has given HIIT a good position in several proposal teams preparing major research activities for submission in 2003.

HIIT's roots are in computer science research, and the majority of its research activities are in the area of information technology. Yet HIIT has also become a meeting ground for researchers from a much wider field, and many of its activities are multi-disciplinary. This was amply demonstrated in the HIIT research portfolio seminar held in September 2002, which published plans for 2003. An especially noteworthy characteristic of many of the plans described was that they involved researchers from several groups within HIIT, and found their motivation and methodology from innovative combinations of their various competences. This shows that the desired added value of combining different talents in HIIT is starting to bear fruit.

All in all, 2002 was a year of expansion and consolidation that firmly established HIIT and within it ARU as a serious research centre. Indeed, impressive progress was achieved on all fronts chosen as objectives for 2002. That this was possible in the unfavorable economic conditions prevailing in the ICT industry and the entire economy, and in a highly competitive environment, shows the dedication and innovativeness of HIIT's research personnel, and the level of commitment of HIIT's industrial partners. HIIT also continued to receive firm support from its two parent universities.

Even though the external conditions for 2003 are also likely to be harsh, the achievements of 2002 have given HIIT a very attractive position to expand and deepen its research even further, and thereby to reach its ultimate objective of having a significant impact on the future progress of the information and communication technologies of the future for the benefit of the Finnish ICT industry and the Finnish information society at large.

2.2 Basic Research Unit (Professor Heikki Mannila)

The Basic Research Unit (BRU) was established in the beginning of 2002. The purpose of the unit is to conduct basic research in specific areas of computer science, chosen so that there are potential applications in sight either in other sciences or in industry. The research activities of BRU are long-term: the applications are not assumed to be immediate.

The basic principles of BRU can be summarized into the following.

- Co-operation between the University of Helsinki and Helsinki University of Technology: As for the whole of HIIT, one of the goals of BRU is to further the co-operation between the two universities.
- Collaboration and mutual support with the Department of Computer Science of UH and with the Department of Computer Science and Engineering of HUT. Basic research and M.Sc. and Ph.D. level education are necessary for each other. Thus BRU operates in the same premises as the departments of computer science, and BRU personnel take an active role in teaching and supervision of graduate students.
- Focused long-term research projects. The goal of BRU is to produce high-quality basic research in computer science. The research projects should be focused so that internationally top-quality work can be achieved. Risks are not to be avoided.

- International co-operation and recruiting. The purpose of BRU is to strengthen the community of computer science research in the Helsinki area. One important tool in this is recruiting from abroad.
- Co-operation with the application groups, both in other sciences and in the industries.

Year 2002 was the first year of operations for the HIIT Basic Research Unit. The research activities were started based on the internationally well-known research in the areas of data mining and computational biology. In this area, there are already good connections to several world-class application groups both in Finland and abroad, and the previous research has a large role in the Academy of Finland's Center of Excellence From Data to Knowledge (FDK), led by Academy Professor Esko Ukkonen. The second research theme, adaptive computing systems, was chosen because of its scientific promise and because of the possibility of fruitful collaboration with Finnish industry.

One of the main tasks in 2002 for BRU was the establishment of the operating mode of the unit. The new bylaws of HIIT, approved by the University of Helsinki and Helsinki University of Technology, made the status of BRU official. As BRU operates on the premises of the departments of computer science, it was decided not to draw tight boundaries for the unit. Thus several persons have important roles both in BRU and in one of the departments of computer science.

BRU is organized loosely along research themes. As mentioned above, the current themes are data analysis and adaptive computation. There is also considerable overlap in the computational methods used in the two themes, and several people participate in both.

The collaboration between BRU and ARU is, of course, of utmost importance. As mentioned above, the role of Dr. Patrik Floréen has been very important in this. Both in the areas of data analysis and in adaptive computing there are good sources for synergy between the two units of HIIT, and the year 2002 gave good indications of this in terms of, e.g., joint projects.

The BRU researchers also engage in day-to-day collaborations with researchers from the two Centers of Excellence of the Academy of Finland: From Data to Knowledge (UH and HUT, Academy Professor Esko Ukkonen) and Neural Networks Research Center (HUT, Professor Erkki Oja).

3 Important Dates

22.3.2002: Dr. George Metakides, Director, Essential Information Society Technologies and Infrastructures, Directorate-General Information Society, European Commission, visited HIIT. A seminar covering selected HIIT research activities and a presentation by Dr. Metakides was arranged.

14.3.2002: The opening event of the research program "Proactive Computing" was held at the Academy of Finland. BRU is coordinating the research program.

3.-5.4.2002: The Fuego program of HIIT organised a Retreat meeting at Tvärminne Biological Station of the University of Helsinki. Some 30 people from HIIT and the industries participated in the event.

4.-7.6.2002: The second HIIT-UCB Summer School was held at the University of California at Berkeley, with professors Kimmo Raatikainen and Randy Katz chairing the event.

15.6.2002: Meeting between professor Manuel Castells and the steering board and research council of the Welfare of Nations project.

18.6.2002: The new management bylaws of HIIT, defining its structure and operation as two closely co-operating units, came into force.

16.8.2002: Vesa Ollikainen, HIIT Researcher in the data analysis group of BRU, successfully defended his Ph.D. thesis *Simulation Techniques for Disease Gene Localization in Isolated Populations* at the University of Helsinki.

19.-23.8.2002: The 13th European Conference on Machine Learning (ECML'02) and the 6th European Conference on Principles and Practice of Knowledge Discovery in Databases (PKDD'02) were arranged in Helsinki. BRU had a central role in the arrangements.

17.9.2002: ARU arranged a seminar describing its planned research portfolio for 2003, prepared for the coming national and European calls.

26.9.2002: The opening ceremony of the Berkeley Center for the Information Society was held at the International Computer Science Institute in Berkeley, California, hosted by Professor Nelson Morgan, Director of ICSI and Dr. Pekka Himanen, Director of the Center. HIIT's The Welfare of Nations project will be one of the first research activities associated with the new Center.

5.11.2002: A joint proposal for co-operation between HIIT and the Department of Computer Science and Technology at the Tsinghua University was accepted and put on "the priority list" in the Tenth Joint Session under the Scientific and Technological Co-operation Agreement between the People's Republic of China and the Republic of Finland.

29.11.2002: Jan Blom, HIIT researcher in the Between project, successfully defended his doctoral thesis *Psychological Implications of Personalised User Interfaces* at the Department of Psychology, University of York, under the supervision of Professor Andrew Monk.

9.12.2002: Anu Kankainen, HIIT researcher in the Between project, successfully defended her doctoral thesis *Thinking Model and Tools for Understanding User Experience Related to Information Appliance Product Concepts* at the Helsinki University of Technology. Her doctorate is the first earned from work largely conducted at ARU.

4 Research

4.1 Advanced Research Unit Activities

The mission of ARU is to conduct strategic research in close co-operation with leading ICT companies, aiming at a significant impact on the future progress of ICT technologies and applications and the progress of the information society.

To achieve this mission, the research in ARU focuses on four thematic areas, each including one or several research groups that may also participate in several areas. The research themes and their scientific leaders are

Fuego: Future Mobile and Ubiquitous Computing (Professor Kimmo Raatikainen)
Intelligent Systems (Professor Henry Tirri)
Media Convergence (Professor Petri Vuorimaa and Professor Eero Hyvönen)
Digital Economy (Doc., Dr. Jukka Kempainen)

The research groups and their senior researchers involved in ARU's work at the end of 2002 were as follows:

Mobile Computing (Professor Kimmo Raatikainen, Dr. Ken Rimey, Dr. Pekka Nikander)
User Experience Research (Dr. Anu Kankainen, Dr. Jan Blom, Professor Martti Mäntylä)
Complex System Computation (Professor Henry Tirri, Dr. Petri Myllymäki, Dr. Wray Buntine, Dr. Jorma Rissanen, Doc., Dr. Patrik Floréen)
Digital Content Communities (Dr. Marko Turpeinen, Dr. Jan Blom)
Interactive Digital Media (Professor Petri Vuorimaa)
Semantic Computing (Professor Eero Hyvönen)
Digital Economy (Dr. Jukka Kempainen, Dr. Pekka Nikander, Dr. Pekka Himanen, Professor Martti Mäntylä)
Product Data Modeling (Professor Reijo Sulonen, Professor Timo Soininen, Dr. Tomi Männistö)

In addition, several researchers from the Industrial Information Technology Laboratory led by Professor Juha Tuominen are closely co-operating with ARU and its User Experience Research group.

The following sections provide a more detailed account of the research activities in each research area.

4.1.1 Future Mobile and Ubiquitous Computing (Fuego)

The objective of the Fuego research area is to develop concepts, technologies, and supporting theories and methodologies needed to design and implement future mobile and ubiquitous

computing services and products. The focus of the research is on new service concepts, adaptive and reconfigurable applications, and mobile Internet middleware solutions that address the specific needs of mobile and ubiquitous computing.

4.1.1.1 Middleware for Mobile Wireless Internet (Fuego Core)

Project leader: Raatikainen, Kimmo

Research group: Mobile Computing

Researchers: Tarkoma, Sasu; Kangasharju, Jaakko; Lindholm, Tancred; Saaresto, Marko; Rimey, Ken; Rantanen, Matti

Schedule: 2002-02-01 ...

Co-operation units: University of Helsinki, Department of Computer Science; University of California at Berkeley

Funding: TEKES; Nokia Research Center; Sonera; Elisa Communications; More Magic Software

Keywords: Mobile Wireless Internet, Middleware services, Mobile Computing, Adaptive Applications

Publications: 9, 55, 56, 86, 91

Research program: Networks of the Future (NETS)

Abstract

The objective of this research project is to specify the set of fundamental enabling middleware services for mobile applications on future mobile environments and to implement two research prototypes. The project has three work areas, which describe the content of the research. The work areas are Adaptive Applications, Dynamic Reconfigurable Services, and Mobile Distributed Information Base. The specification of the middleware service set for applications in future Mobile Wireless Internet is experimented and evaluated using two prototype implementations. The implemented prototypes are used to show how services can be deployed on the proposed middleware services. The project will be executed in close co-operation with the research group of Professor Randy Katz at the University of California at Berkeley (UCB). In addition, the project monitors and contributes to relevant middleware standardization bodies; for example IETF, OMG, W3C, and OntoWeb.

Progress in 2002

During the first phase of the project (year 2002) we surveyed literature, technology and standards relevant for research on middleware for Mobile Wireless Internet and produced a specification for the first middleware service set. A prototype implementation of the first service set was created as a proof-of-concept. The first middleware service set contains the following key enablers for applications: distributed events, SOAP messaging, synchronizing XML-aware file systems, and presence service. The first middleware service set is implemented in 2003. After experimentation with the first set, a second service set will be specified and implemented in 2004.

4.1.1.2 Ubicomp Bubbles Enhancing Human-Human and Human-Computer Interaction (Between)

Project leader: Mäntylä, Martti

Research group: User Experience

Researchers: Kankainen, Anu; Kankainen, Tomi; Oulasvirta, Antti; Rantanen, Matti; Tiitta, Sauli; Blom, Jan; Nurminen, Antti; Samarin, Michael; Kurvinen, Esko

Schedule: 2001-06-01 ... 2003-03-31

Co-operation units: University of Industrial Arts Helsinki, Department of Industrial Design; Industrial Information Technology Laboratory, Helsinki University of Technology

Funding: TEKES, Nokia Research Center, Sonera; Elisa Communications; Alma-Media; Sanoma-WSOY

Keywords: Ubiquitous computing, Mobile computing, Scenario methods, Concept design, User-centric product design

Publications: 29, 43, 85

Research program: Networks of the Future (NETS)

Abstract

The aim of the BETWEEN project is to study and create ubiquitous computing product and service scenarios and prototypes that would meet people's needs at home, work and in public contexts. Both theoretical and constructive goals of the project will be accomplished by altogether 15 project tasks. The research team is multidisciplinary, including computer scientists, a psychologist, cognitive scientists, and industrial designers.

The project team uses the metaphors *personal bubble* and *application bubble* to describe its approach to ubiquitous computing research. A personal bubble is around an individual user. It is possible only when the user is carrying a digital item with her/himself. An application bubble is around an object in the user's physical environment. A personal bubble enables the user to form ad-hoc networks with other people with a personal bubble. Moreover, it enables the user to get connected with application bubbles.

The constructive work of the project is based on an ethnographic study of 25 adults moving about in an urban environment. The narrative-form data about how people complete daily activities and incorporate mobile technology into their routines are used to create service scenarios and concepts. To maintain user focus, probing and prototyping are incorporated in the design process.

Progress in 2002

During 2002, the project progressed through the concept design, interaction design, and prototype development stages of the project plan. Between the stages of the project, four gate meetings were held with the industrial partners of the project. Despite having somewhat smaller resources than planned, the project managed to maintain its schedule except for a 2-week delay in prototype testing late in the year.

4.1.1.3 Software Architectures for Configurable Ubiquitous Systems (Sarcous)

Project leader: Sulonen, Reijo

Research group: Product Data Management Group (PDMG)

Researchers: Männistö, Tomi; Soininen, Timo; Asikainen, Timo; Kojo, Tero; Multimäki, Mikko; Raatikainen, Mikko; Ylinen, Katariina

Research unit: Software Business and Engineering Institute, Helsinki University of Technology; TAI Research Centre

Schedule: 2000-09-01 ... 2003-12-31

Funding: TEKES; Nokia Mobile Phones; Sonera

Keywords: configurable products, software architectures, software design and specification methods, software configuration management

Publications: 18, 69, 84

Abstract

We study a new approach to the development of software and service families based on the concept of a configurable software product family. The objectives of Sarcous are to study and formulate methods for managing software product families and re-usable software components on the basis of modeling them as configurable software products. The re-usable components may be requirements, features, designs, architectures, design components or implementations of some aspect of the software or service.

The method developed embodies the understanding of the real needs by surveying software product families in the Finnish industries, developing the conceptual basis and modeling methods for managing configurable software and service families and demonstration and validation of the results by applying them to configuration of Linux Familiar distributions as well as industrial products.

The project is executed as a co-operation between HIIT and the TAI Research Centre.

Progress in 2002

Present work aims at combining and further developing techniques for 1) management and configuration of configurable products, and 2) re-use of software, particularly domain engineering, application generators, software product line architectures, frameworks, reusable component based software, and software configuration management. The research is carried out in co-operation with two industrial companies to ensure the practical relevance and feasibility of the results.

4.1.1.4 European Virtual Testbed for Location-Sensitive Ubiquitous Services (Evius)

Project leader: Mäntylä, Martti

Research groups: Mobile Computing, Digital Economy

Researchers: Kontiainen, Mikko; Puolakka, Anton; Hietanen, Herkko

Schedule: 2002-06-01 ... 2003-03-31

Co-operation units: Otaverkko Oy; VTT Information Technology; Finnish Geodetic Institute

Funding: TEKES, Navinova Oy

Keywords: Mobile services, Location-sensitive services

Abstract

The ultimate objective of the project is to contribute to the establishment of a Europe-wide network of test sites for future mobile services.

The project builds on the basis of the NAVI Programme (2000-2002) that focused on location-based services. Building on the NAVI network established in the program, the project aims at (i) establishing a testbed in the Helsinki area for new mobile services by networking manufacturers, operators, content providers, and service builders; (ii) linking this activity with other Finnish testbeds such as the Octopus testbed in Oulu to establish a coordinated entity termed "Testbed Finland"; and (iii) seeking contact with other European similar test sites to provide facilities for multi-site testing.

The envisaged testing environment should support service testing from multiple viewpoints, including technical interoperability, business interoperability, and end-user acceptance.

Progress in 2002

The project was launched in August 2002. During the fall 2002, the main activity of the project was aimed at creating a partner network of companies that are already active in the field and that already have relevant test resources. Several interviews with technical experts were conducted. An initial partnership was created and first plans of the testbed network were made.

4.1.1.5 Context Recognition by User Situation Data Analysis (CONTEXT)

Project leader: Mäntylä, Martti

Research group: User Experience

Researchers: Kankainen, Anu; Tiitta, Sauli; Rantanen, Matti

Schedule: 2002-11-01 ... 2005-12-31

Funding: Academy of Finland

Publications: 91

Co-operation units: HIIT BRU

Keywords: Proactive computing, Ubiquitous computing, Presence service, Instant messaging, Data analysis, Data mining

Research program: Proactive Computing (PROACT), Academy of Finland

Abstract

The Context project studies characterization and analysis of information about user context and its use in proactive adaptivity. In mobile and ubiquitous applications and systems, reacting to user context is a key component of proactivity: changes in the user's situation are rapid and they are strongly reflected in the user's needs and preferences.

We focus on the utilization of user context: how does the context reflect the user's motivations, how to make automatic inferences about the contexts, and how to characterize contexts to users and design user interaction about contexts? These questions are considered in the framework of an example application: mobile messaging, a representative ubiquitous application whose usability greatly depends on how context-sensitively communication is managed. We adopt a multidisciplinary approach; the research problems are approached by qualitative user studies, data analysis algorithm development, and empirical testing in a prototype environment.

The key results aimed at are (1) methods for utilizing qualitative user situation descriptions in the development of context-sensitive applications, (2) algorithms for context analysis and characterization, and (3) models for user interaction about context. The project will also produce a prototype of a context-sensitive mobile communication application.

The project is a joint activity of ARU and BRU. It belongs to the Proactive Computing program of the Academy of Finland.

Progress in 2002

The ARU part of the project started in November 2002 with qualitative user studies aimed at revealing how users interpret context descriptions and generally context structures. See Section 4.2.1.2 for the progress of the BRU part.

4.1.2 Intelligent Systems

The Intelligent Systems research area focuses on theoretical and applied aspects of modeling and data analysis - especially with probabilistic graphical models and information theoretical

approaches to inference, in particular Minimum Description Length principle (MDL). The work has a strong basic research component, being at the intersection of computer science, information theory and mathematical statistics. The results of this methodological work are applied both in science and industrial applications resulting in advanced prototypes and fully fielded applications. The recent main applied research areas include PetaByte-level scalable next-generation information search, future networked learning environments, location-aware personalized services and multi-disciplinary applications of modeling in social sciences, medicine and biology.

4.1.2.1 Personalized Adaptive Interfaces (PAI)

Project leader: Tirri, Henry

Research group: Complex System Computation

Researchers: Myllymäki, Petri; Lahtinen, Jussi; Lepola, Tuomas; Miettinen, Miikka; Nokelainen, Petri; Wettig, Hannes; Valtonen, Kimmo; Tuominen, Antti; Tuulos, Ville

Schedule: 2002-01-01 ... 2002-12-31

Funding: Tekes; Alma Media; Ekahau; BayesIT

Publications: 33, 34, 35, 36, 42, 44, 45, 46, 57, 63, 67, 79, 115

Keywords: Personalization, Adaptive interfaces, Probabilistic modelling, Bayesian networks

Research program: USIX

Abstract

The main objective of the PAI project is to develop methods for applying probabilistic modelling techniques, such as Bayesian network models, in building and using personalized, adaptive user interfaces. Specific research problems include user data segmentation, user profiling and user identification, and location-aware computing. The associated pilot-projects focus on problems related to intelligent educational technologies (EDUTECH), adaptive WWW services and adaptive mobile services.

Progress in 2002

Year 2002 was the final year of the project. In the area of adaptive WWW services, the models developed in the project were empirically tested by using the real-world WWW log data provided by Alma Media. Similarly, the results developed in the area of intelligent educational technologies were also implemented and tested in real-world environments. The results obtained in the empirical tests were quite promising.

4.1.2.2 Computationally Efficient Methods for Deep Computing (DeepC)

Project leader: Tirri, Henry

Research group: Complex System Computation

Researchers: Myllymäki, Petri; Buntine, Wray; Rissanen, Jorma; Perttu, Sami; Silander, Tomi; Wettig, Hannes; Mononen, Tommi; Lahtinen, Jussi; Lepola, Tuomas; Nokelainen, Petri; Roos, Teemu; Uronen, Pekka.

Schedule: 2000-01-01 ... 2003-12-31

Funding: Academy of Finland

Publications: 4, 10, 11, 21, 22, 26, 67, 71, 79, 115

Keywords: Personalization, Adaptive interfaces, Probabilistic modelling, Bayesian networks, Deep computing, Stochastic modelling, Stochastic optimisation, Data visualization

Research Program: Madame

Abstract

Deep Computing is a term for methods solving complex and large-scale modeling and analysis problems with emerging computer systems that combine ultra-fast processing with sophisticated analytical software. The methodological research objective of the DeepC project is to develop the theory and methods required for obtaining very large-scale computational, data and communications capabilities that can be used to solve "grand challenge"-level Deep Computing problems in business and science. The research focuses on stochastic approaches and is methodological and theoretical in nature, and aims at topics that can have great impact in this area in the future. From the applied research point of view, the main objective is to demonstrate solutions to previously intractable business and scientific problems by exploiting the advances in Deep Computing research in areas such as data modelling and analysis, high-end computing, search and optimisation algorithms, and high-dimensional visualization. Such demonstrations will often be results of joint multi-disciplinary work together with scientists (scientific problems) as well as the industries (business problems).

Progress in 2002

In 2002 the research focused on developing methods for learning graphical models (Bayesian networks) from data. The results were incorporated in the publicly available data analysis tool B-Course (<http://b-course.hiit.fi>), maintained as an ASP service by the research group. The latest version of B-Course became operational in 2002, and it facilitates not only unsupervised dependency and causal modelling, but is also a tool for supervised classification and regression tasks. The feedback from the thousands of users of B-Course has been very good, and the source code has also been delivered to MIT for example for additional specialized development.

4.1.2.3 Minimum Description Length Modeling in Computer Science and Statistics (Minos)

Project leader: Tirri, Henry

Research group: Complex System Computation

Researchers: Myllymäki, Petri; Rissanen, Jorma; Perttu, Sami; Roos, Teemu.

Schedule: 2002-01-01 ... 2005-12-31

Funding: Academy of Finland

Keywords: Minimum description length principle (MDL), stochastic complexity, universal modelling, model selection, predictive inference.

Abstract

The objective of this research is to develop and study the Minimum Description Length (MDL) approach to modelling and its relationship to other probabilistic approaches used in computer science and statistics. Formally MDL modelling is approached from various directions including Fisher's Maximum Likelihood Principle and minimax formulations leading to universal coding which extend Shannon's Source Coding Theorem. In particular we will focus on the recent Normalized Maximum Likelihood formulation of MDL, as well as in the predictive form (PMDL), properties of which are not yet well understood. The emphasis on applying the theoretical work will be in computationally efficient model selection and prediction problems in computer science, but the results are widely applicable in statistical modelling in general including regression, cluster analysis and curve estimation. The developed methods will be implemented and empirically validated in several real-world problem domains.

Progress in 2002

In 2002 the project focused on the following topics: First, extending stochastic complexity, the central notion of MDL research, to nonlogarithmic loss functions. Second, applying MDL modelling for data denoising. Third, studying the connections between the formal foundation of the MDL principle and the Kolmogorov structure function.

4.1.2.4 Multivariate Biological Data Analysis (Bidma)

Project leader: Tirri, Henry

Research group: Complex System Computation

Researchers: Myllymäki, Petri; Lahtinen, Jussi; Perttu, Sami; Valtonen, Kimmo; Tuominen, Antti

Schedule: 2002-08-01 ... 2003-07-31

Funding: Kibron, Inc.

Keywords: Drug development, data analysis

Abstract

The pharmacokinetic ADME (absorption, distribution, metabolism, excretion) parameters are of prime interest in searching for the desired beneficial effects of drugs with minimal adverse effects.

The goal of the BIDMA project is to develop methods for early ADME prediction and study how the developed methods can be used in drug design.

Progress in 2002

The project was launched in August 2002. During the fall 2002 research focused on developing predictive models for blood brain barrier permeation and bioavailability. The main emphasis was on discovering the most helpful features while keeping the cost efficiency of the data gathering process for the selected variables in mind as well.

4.1.2.5 Computationally Efficient Probabilistic Learning and Reasoning (Cepler)

Project leader: Myllymäki, Petri

Research group: Complex System Computation

Researchers: Kontkanen, Petri; Ojanpää, Sami.

Schedule: 2000-01-01 ... 2004-12-31

Funding: Academy of Finland

Publications: 4, 67, 79, 89

Keywords: Uncertain reasoning, machine learning, probability theory, Bayesian networks

Abstract

The probability theory offers a theoretically solid and versatile framework for building models from empirical data and/or expert knowledge. Although the advantages of probabilistic models have been largely recognized, the approach has often been neglected as the theoretically correct, but computationally infeasible methodology. The goal of this research is to explore theoretically valid, but still computationally efficient methods for probabilistic modelling and to develop techniques that can be used for solving both predictive (regression, classification) and explorative (data mining, visualization, causal reasoning) modelling tasks.

Progress in 2002

One of the main discoveries made in the project has been that some of the commonly accepted hypotheses in modelling are not necessarily true, at least not in practical situations. An example of this type of a situation is the misconception about the difference between unsupervised and supervised learning. Namely, if one is capable of representing the joint domain probability distribution exactly, there is no difference between the results of the supervised and unsupervised approach, which has led people to believe that unsupervised learning criteria can safely be used also in supervised modelling tasks. We have been able to show that as in practice our approximation of the domain joint distribution is always a poor one, there can be a huge difference between the results of the supervised and the unsupervised approach. This observation has later also been supported by other researchers.

4.1.2.6 Probabilistic Modelling of Baltic Salmon Stocks (Promos)

Project leader: Tirri, Henry

Research group: Complex System Computation

Researchers: Myllymäki, Petri; Valtonen, Kimmo; Mononen, Tommi

Schedule: 2000-03-01 ... 2002-05-31

Funding: European Commission

Publications: 93

Co-operation units: Finnish Game and Fisheries Research Institute, Swedish Salmon Research Institute, Swedish University of Agricultural Sciences, Imperial College of Science, Technology and Medicine

Keywords: Fishery management, Baltic salmon, Probabilistic modelling

Research program: Studies in Support of the Common Fisheries

Abstract

The objectives of the project are: 1. To develop a rigorous probabilistic assessment methodology for Baltic salmon stocks. 2. To undertake an application of the developed methodology by estimating the status of salmon stocks in the Gulf of Bothnia through a rigorous evaluation of Swedish and Finnish river data sets. 3. To develop a Bayesian decision analysis methodology for fisheries management of Baltic salmon and to give advice for the practical management. 4. To analyse combined use of TAC management and effort regulation of passive gears in the coastal trap-net fishery of a mixed stock fishery and the information requirements of these management methods. 5. To identify the key sources of uncertainty and most effective management control measures given the uncertainties. In this study, preliminary estimates will be obtained for the historical development and present status of the case study Baltic salmon stocks by combining various old and new data sets from rivers. This information will improve the empirical and scientific foundation for the ongoing Salmon Action Plan and for the yearly quota decision-making of the Baltic Sea fisheries.

Progress in 2002

During year 2002, the final year of the project, the research produced predictive models for wild smolt production in rivers of the Gulf of Bothnia along with predictive models for secondary indicators of wild salmon abundance. The transfer of knowledge across different rivers was assessed empirically as well. The model family used is a novelty in fisheries science. Additionally, site selection bias in electrofishing, an essential part of the data gathering process, was analysed via a methodology that is a novel one in the field of study.

4.1.2.7 Proactive Information Retrieval by Adaptive Models of Users' Attention and Interests (Prima)

Project leader: Myllymäki, Petri

Research group: Complex System Computation (CoSCo)

Researchers: Tuulos, Ville; Miettinen, Miikka

Schedule: 2003-01-01 ... 31-12-2005

Funding: Academy of Finland

Co-operation units: Neural Network Research Center (NNRC) at Helsinki University of Technology, Center for Knowledge and Innovation Research (CKIR) at Helsinki School of Economics

Keywords: proactive information retrieval, probabilistic models, machine learning, user modeling, eye movement tracing

Research program: Proactive Computing (PROACT), Academy of Finland

Abstract

Successful proactivity, i.e. anticipation, in varying contexts requires generalization from past experience. Generalization, on its part, requires suitable powerful (stochastic) models and a collection of data about relevant past history to learn the models. The goal of the project is to build probabilistic and neural computing-based models that learn from the actions of people to model their intentions and expectations, and use the models for disambiguating the users' vague commands and anticipate their actions. The actions and interests are monitored by measuring eye fixations and movements that exhibit both voluntary and involuntary signs of both the cognitive state of the user and his intentions. The models will be implemented and incorporated into a software tool offering a platform for applications in a prototype area, proactive information retrieval. The goal of the user, to find relevant pieces of information, is hidden from the system and will be inferred from actions. The models combine information about current actions, past history of actions, and overall interest profiles of several users to make inferences of the current interests and to progressively focus the retrieval. The platform will be applied in several areas, including document search from scientific and other databases, automated helpdesks, and e-learning.

4.1.3 Media Convergence

The Media Convergence research area studies the entire production, distribution, and use process of future digital media services from contents production to service delivery through various channels such as mobile terminals, digital TV, or the Internet. Its core research topics include content management (contents production, archival, indexing, structuring, semantics), service management, and content delivery.

4.1.3.1 XML Devices

Project leader: Vuorimaa, Petri

Research group: Interactive Digital Media

Researchers: Honkala, Mikko; Heng, Guo; Sivaraman, Ganesh; Santala, Jukka; Vierinen, Juha

Schedule: 2001-09-01 ... 2004-08-31

Co-operation units: Laboratory of Telecommunications Software and Multimedia

Funding: TEKES; Sonera; Elisa Communications; Alma-Media; Finnish Broadcasting Corporation; Almare; Mind on Move; Sofia Digital; Solagem

Keywords: XML

Publications: 20, 27, 48, 61, 62, 64

Research program: SPIN, Tekes

Abstract

The XML Devices project's main goal is to implement a client-side environment for XML-based services. The project is based on the open source XML browser X-Smiles, which is written in Java. The project develops the browser further and ports it to different kinds of user devices, such as PDAs and MHP-enabled digital television set-top-boxes.

Progress in 2002

In the year 2002 the project has developed further the X-Smiles browser, which is designed for presenting dynamic multimedia content in XML format. In addition, the project has researched embedded Java environments and adapted them to run the X-Smiles browser. The project has also developed further the support for different XML languages in the X-Smiles browser. Results of the project are the first browser implementations of XForms and XML Events. The project is also a member of the W3C XForms working group and has significantly contributed to the specification work. The project has also done a study of current restricted or embedded Java environments and also ported X-Smiles into these environments.

In the future both the mobile and digital television environments will converge. Both are moving towards Java environments and use XML as the markup language. XHTML and SMIL are important XML languages. For instance, iMode and WAP are adopting XHTML. Digital television's supertext system is based on XHTML, as well. SMIL is used, e.g., in MMS messaging. XForms is an interesting new technology for complex interactive forms on the Web. The XML Devices project has researched and developed especially Java/XML environments.

4.1.3.2 Semantic Web

Project leader: Hyvönen, Eero

Research group: Semantic Computing

Researchers: Raatikka, Vilho; Viljanen, Kim; Kettula, Suvi-Päivikki; Saarela, Samppa

Schedule: 2002-01-01 ... 2003-12-31

Co-operation units: Department of Computer Science, University of Helsinki

Funding: TEKES, Nokia, TietoEnator, Espoo City Museum, Helsinki University Museum, National Board of Antiquities, Antikvaria group

Publications: 28, 70, 73, 74, 75, 76, 95, 97, 98, 99, 100, 101, 102, 103, 104, 105

Keywords: Semantic Web

Abstract

The project develops Semantic Web technology for publishing and using semantically complex database content on the Web. Research is conducted through case studies. The first case is "Finnish Museums on the Semantic Web" (FMS), a web service for making distributed Finnish museum collection data interoperable and accessible from one point to end users. The second case is the design and implementation of a semantic browser and a semantic recommendation system for the image archive of the Helsinki University Museum. The third case study is a semantic browser for a mobile telephone.

Progress in 2002

A technology survey of Semantic Web technologies and museum systems was conducted. The FMS system was designed, a test ontology for it created, transformation of relational data form databases into the RDF(S) format studied, and some actual test data transformed and annotated for the FMS demo system. To disseminate knowledge and results, the project participated in organizing the conference "Towards the Semantic Web and Web Services: XML Finland 2002" in Finland. The project also represented HIIT in the European OntoWeb research network (<http://www.ontoweb.org>) on the Semantic Web.

4.1.4 Digital Economy

The main objective of the research carried out by the Digital Economy research area is to develop concepts, models, processes, facilities, platforms, and infrastructures that provide foundations for creating products and services for digital economy. Also this objective should be understood in a wide sense so that, in addition to ICT tools for digital transactions, payment protocols, security and privacy, etc., the program also studies, for instance, business models that facilitate and encourage the operation of digital markets.

4.1.4.1 Structures of Digital Economy (DE Core)

Project leader: Kempainen, Jukka

Research group: Digital Economy

Researchers: Virtanen, Perttu; Soininen, Aura; Sarvas, Risto; Mäntylä, Martti

Schedule: 2002-01-01 ... 2004-12-31

Co-operation units: University of California at Berkeley

Funding: TEKES; Nokia Research Center; Sonera; Elisa; Ericsson; Sanoma WSOY; Finnish Post Corporation; Nixu Oy

Publications: 50, 54, 88, 92

Keywords: Digital economy, Computer law, Electronic commerce, Mobile computing

Research program: Business Concepts for Industries, Tekes

Abstract

The research area of the DE Core project can be visualised as a triangle defined by technological constraints, legal constraints, and business methods as a choice of available, feasible, and viable possibilities. In this scope, the main objectives of the project are:

1. Developing a holistic understanding of the technical, economical, and societal aspects that influence the future progress of the mobile digital economy and the digital markets in general.
2. Identification and understanding of emerging economical structures consistent with the expected progress of the mobile digital economy. This involves identifying and understanding the actors and stakeholders in the structure (buyers, sellers, 3rd parties); their roles and responsibilities; the dynamics of these relationships; and the main transactions needed during the life cycle of services rendered.
3. Understanding the requirements that the emerging economical structures pose to the underlying market infrastructure, with emphasis on the legal, organisational, or policy/societal aspects.
4. A prototype demonstrating an interesting business structure for providing a chosen digital service on the mobile Internet.

Most of these objectives are expressed as developing an understanding of some phenomenon or its characteristics. This makes the role of the prototype critical to express the wisdom gained in a concrete and easily adoptable form.

Part of the work is performed at the University of California at Berkeley.

Progress in 2002

The DE Core research work has progressed in 2002 according to the original project plan as adjusted by the DE Core Steering Committee. Jukka Kempainen, Perttu Virtanen and Aura Soininen have carried on the study in Finland, while Risto Sarvas commenced research at University of California at Berkeley from August 2002. The research has yielded a number of

research papers, articles and presentations both in Finland and abroad together with the planned seminar days and research topic get-togethers with partners and other research institutions and universities.

4.1.4.2 Digital Rights Management in Mobile Services (MobileIPR)

Project leader: Kempainen, Jukka

Research group: Digital Economy

Researchers: Pitkänen, Olli; Välimäki, Mikko; Oksanen, Ville; Reti, Tommo

Schedule: 2000-09-01 ...

Co-operation units: University of California at Berkeley, USA; Software Business and Engineering Institute (SoberIT), Helsinki University of Technology

Funding: TEKES; Nokia; Sonera; Elisa Communications; Finnish Broadcasting Corporation

Publications: 47, 49, 50, 51, 52, 65, 66, 90, 107, 108

Keywords: Intellectual Property Rights (IPR), Digital Rights Management (DRM), Wireless Networks, Mobile Internet, Information Products

Abstract

The project aims at sorting out the intellectual property rights (IPR) management in the new business and technology environment. Wireless networks and mobile terminals along with the digital media bring forward new legal problems. The focus is on copyright and patent, but issues like the liability of intermediaries, agreements on those rights and liabilities as well as their management are covered in the project. An important part of the research is carried out in California.

The MobileIPR project studies intellectual property rights (IPR) management in the changing business and technology environment. Digital Rights Management (DRM) is becoming a key issue in the distribution of information products. Wireless networks and mobile terminals along with the digital media bring forward new legal problems. The research focus is on copyright and patent, but issues like the liability of intermediaries, agreements on rights and liabilities as well as their management are studied.

The project has two locations. The project home is at the Helsinki Institute for Information Technology HIIT in Helsinki, Finland. An important part of the research work is carried out at the School of Information Management and Systems (SIMS) at UC Berkeley, California. The project work in California is closely connected to the leading expertise of UC Berkeley in information society study at large and the activities of many private and public special interest organizations around the San Francisco Bay Area.

The project was launched in September 2000 and is scheduled to continue until mid 2003. The project is based on a joint research project by Helsinki University of Technology and Nokia Research Center during 1999-2000.

Progress in 2002

The project has been carried out in accordance with the project plan. Ville Oksanen stayed most of the year at University of California at Berkeley. The rest of the project team was in Helsinki. The project has produced a number of publications. In addition, the project with a group of seven students at Helsinki University of Technology produced a demo DRM system called the Nonius DRM tool. Co-operation with companies and other research institutes has been fruitful. Besides the above-mentioned collaboration with University of California at Berkeley, especially connections with Lappeenranta University of Technology have been intensive and produced good results.

4.1.4.3 Security Technologies and User Attitudes in Mobile IPR (STAMI)

Project leader: Mäntylä, Martti

Research group: Digital Economy

Researchers: Kortesianen, Yki; Heikkilä, Juho; Kanerva, Pekka; Parhankangas, Juha

Co-operation units: Laboratory of Telecommunications Software and Multimedia

Funding: TEKES; Nokia; Elisa Communications; Ericsson

Publications: 31, 32, 52, 87

Schedule: 2001-03-01 ... 2003-12-31

Keywords: Security, Privacy, Certificates, Intellectual Property Rights

Abstract

The STAMI project aims at managing information validity as well as end user privacy in the distribution of digital content to mobile terminals. Mobile networks enable new business models, where the user fetches the required content from the network on a need basis. On the other hand, this raises questions about the validity of information as well as how to maintain sufficient end user privacy against usage monitoring. STAMI is a 2,5-year research project with a combined effort of 163 man-months. The deliverables are concepts, scientific papers, licentiate's theses, research prototypes and a doctoral dissertation.

Progress in 2002

We have developed a distribution channel where the users' mobile terminals participate in distributing the content by forming mobile peer-to-peer networks over short range wireless connections, such as Bluetooth or WLAN.

In 2002 we developed a concept prototype of a news service that utilises our distribution technology. We then worked on a technology prototype on a Bluetooth-enabled mobile phone. In 2003 we will look at giving end-users the chance to act as content creators with their mobile terminals and we will develop a prototype demonstrating this in the context of a news service.

4.1.4.4 The Welfare of Nations

Project leader: Kemppinen, Jukka

Research group: Digital Economy

Researchers: Himanen, Pekka; Kalliokoski, Matti

Schedule: 2002-01-01 ... 2003-12-31

Co-operation units: Berkeley Center for the Information Society, University of California at Berkeley

Publications: 80

Funding: TEKES

Keywords: Information society, Digital economy

Abstract

The two-year Welfare of Nations project will study the interaction of technology, economy, and society through a comparison of three successful information societies: Silicon Valley / USA, Singapore / Greater China, and Finland / EU.

The project will be carried out in close co-operation with the Berkeley Center for Information Society at the University of California at Berkeley. It is intellectually a continuation of the research project carried out by Professor Manuel Castells and Dr. Himanen which resulted in the book "The Information Society and the Welfare State - The Finnish Model" (Oxford University Press, 2002)."

The current research team consists of Dr. Pekka Himanen and M.Pol.Sc. Matti Kalliokoski. Professor Castells will contribute to the project by co-authoring an article with Dr. Himanen comparing the progress of Silicon Valley, Finland, and Singapore.

Progress in 2002

Year 2002 was the first year of the Welfare of Nations project. The researchers have focused on gathering background information and case studies. The work has been carried out both in Helsinki at HIIT and Berkeley at the Berkeley Center for Information Society. Research trips have been made to, e.g., Singapore and EU institutions. The project has been able to utilise contributions by world-class experts at Berkeley. During spring and summer the team also had a research assistant on a short-term contract. In June 2002, the project arranged a special meeting in Helsinki between Professor Manuel Castells and the members of the steering board and the research council of the Welfare of Nations project.

The project enters its second and so far its last year in 2003. The aim is to produce manuscripts for research reports and related publications during the year, but there are also plans for a continuation of the project.

4.1.4.5 Regulation of Location Services

Project leader: Kemppinen, Jukka
Research group: Digital Economy
Researchers: Simojoki, Samuli; Tervo-Pellikka, Raija
Schedule: 2001-01-01 ... 2002-12-31
Funding: NAVI network
Publications: 96, 110, 111, 112, 113, 114
Keywords: Mobile computing, Location services, Privacy
Research program: NAVI

Abstract

The Regulatory Framework support project was one of the support projects of NAVI Programme and a part of the Digital Economy Research Program at HIIT.

The goal of the Regulatory framework support project was to study and report on the regulation affecting the development, provision and utilisation of positioning technology-based services. The project made studies of the impact of the regulatory environment on services and business models based on utilisation of positioning technology and development of the regulation from the point of view of fundamental data protection principles. A research activity concerning intellectual property issues related to utilisation of location data and spatial data and relevant legislation in Finland, USA and Japan was conducted.

The study was completed in 2002.

4.1.4.6 Digital Economy Issues in Transportation Telematics

Project leader: Simojoki, Samuli
Research group: Digital Economy
Researchers: Hohti, Marja; Airaksinen, Jukka
Schedule: 2002-01-01 ... 2002-12-31
Funding: Ministry of Transport and Communications
Publications: 94
Keywords: Transportation telematics
Research program: FITS

Abstract

Intelligent transport systems (ITS) are technologies and systems whereby data concerning transport infrastructures, traffic and mobility are collected and processed. ITS services apply information technology in different products and services for passenger and goods transport. These data can be utilized, inter alia, in traffic control, information provision, positioning, route planning,

and logistic services. Transport telematics also makes it possible to try to influence the demand of transport, modal split, route selection, the timing of journeys and traffic behaviour. To sum up, the basic problem of the research area is the novelty of transport telematics. This means, first, that the large-scale use of basic data is only just starting, and, second, that no uniform practices or data policies have yet formed.

The objective of the study was to explore the basic problems in the production and dissemination of basic data for ITS applications and make recommendations for solutions. The study was assigned by the Ministry of Transport and Communications and it covers the administrative area of the ministry and certain closely related areas. The study was completed in 2002.

4.1.4.7 Creative Commons

Project leader: Kemppinen, Jukka

Research group: Digital Economy

Researchers: Hietanen, Herkko

Schedule: 2002-10-01 ...

Funding: HIIT internal

Publications: 88

Keywords: Open source; Digital Rights Management

Abstract

The Creative Commons is devoted to expanding the range of creative work available for others to build upon and share. Creative Commons' aim is not only to increase the sum of raw source material online, but also to make access to that material cheaper and easier. To this end, Creative Commons has also developed metadata that can be used to associate creative works with their public domain or license status in a machine-readable way. Creative Commons and we hope this will enable people to use our search application and other online applications to find, for example, photographs that are free to use provided that the original photographer is credited, or songs that may be copied, distributed, or sampled with no restrictions whatsoever. We hope that the ease of use fostered by machine-readable CC-licenses will further reduce barriers to creativity.

Progress in 2002

Digital economy started a research co-operation with Creative Commons Corporation located at Stanford law school in fall 2002. The role of HIIT will be localisation of Creative Common's licenses and studying the impact of the Creative Commons system to the global creative content market.

4.2 Basic Research Unit Activities

The mission of BRU is to conduct basic research in computer science. The unit works in close collaboration with application groups in other sciences (such as medical genetics and structural biology) and in the industries. During its first year of operation, the activities of BRU took place in two main research areas: adaptive computing systems and data analysis.

4.2.1 Adaptive Computing Systems

Adaptive computing focuses on the methodology and implementation of systems that adjust to different situations. An adaptive system may change its own behavior to the goals, tasks, interests, and other features of individual users. It may be context- or situation-aware adapting to changes in location, time and user activity. Adaptive computing plays an important role in ubiquitous and pervasive computing as well as in intelligent and user-friendly applications.

4.2.1.1 Coordination of Research Program on Proactive Computing

Program leader: Mannila, Heikki

Program coordinator: Lindén, Greger

Schedule: 2002-01-01 ... 2005-12-31

Research program: Proactive Computing (PROACT), Academy of Finland

The Basic Research Unit coordinates the Research Program on Proactive Computing (PROACT) jointly funded by the Academy of Finland, Tekes, the National Agency of Technology of Finland and the French Ministry of Research. Professor Heikki Mannila is the Program Director and Dr. Greger Lindén the Program Coordinator. The program is scheduled to run for three years (2002-2005) and the total funding is about 8 million euro. The objectives of the program include supporting high quality research in the field of proactive computing. The program is also expected to boost co-operation between Finnish and French researchers and to help maintain the high level of information technology research in both countries.

A proactive computing system adapts and adjusts to a user's movements and actions without requiring any conscious control. It may be embedded into an intelligent environment or into auxiliary devices used by the elderly or disabled. Above all, proactive applications seek to make our everyday life easier. Such terms as ubiquitous computing and pervasive computing refer to areas covered by proactive computing.

The Board of the Academy of Finland decided on 6 November 2001 to launch the program. The Board also appointed a steering group on 11 December 2001 and started negotiations with French Research Councils and Tekes. The steering group chose BRU as the coordination unit in January 2002, and since that BRU has participated in the preparation of the program. The program call was launched on 14 March 2002. Applications were processed in two stages. In the first stage, 46 plans of intent were submitted. 23 of these were asked to submit a full proposal by the funding organisations. An international evaluation panel met in Paris in September to assess these proposals. On its recommendation, fourteen projects were finally chosen to be funded by the program. HIIT is participating in three of these projects. These are Context Recognition by User Situation Data Analysis (CONTEXT), Networking and Architecture for Proactive Systems (NAPS) and Proactive Information Retrieval by Adaptive Models of User's Attention and Interests (PRIMA). The activities of these research projects commenced in full scale at the beginning of 2003. CONTEXT is a collaborative project of ARU and BRU.

The first projects started their work in November 2002. All fourteen projects will go on for three years ending in late 2005 after which the whole program and its results will be evaluated. Out of the fourteen projects, three projects involve both Finnish and French research teams and are jointly

funded by all the funding organisations. The remaining eleven projects are all funded by the Academy of Finland. Eight of them are Finnish-only consortia where two or more Finnish research teams are involved and three of them are individual Finnish projects.

The objective of the coordination is to guarantee that the projects form a coherent program by co-operating and benefiting from each other's work. The coordination unit also seeks to establish international connections to similar programs and research and to arrange conferences and seminars in the field. The coordination will also produce written reports about the progress of the program. For more information about the program, see its web pages at <http://www.aka.fi/proact/>.

4.2.1.2 Context Recognition by User Situation Data Analysis (CONTEXT)

Project leader: Toivonen, Hannu

Research group: Adaptive Computing Systems

Researchers: Raento, Mika; Laasonen, Kari

Schedule: 2002-11-01 ... 2005-12-31

Co-operation units: HIIT ARU

Keywords: Context recognition, mobile devices

Research program: Proactive Computing (PROACT), Academy of Finland

Led by Professor Hannu Toivonen, this project looks at ways of analysing usage data from mobile services to enable mobile devices to recognize the context in which they are used and to adapt their behaviour appropriately. This joint BRU/ARU project is part of the Research Program on Proactive Computing of the Academy of Finland (see above), and it started in November 2002.

4.2.1.3 Sensor Data Analysis for Mobile Devices

Project leader: Ollikainen, Vesa

Research group: Adaptive Computing Systems

Researchers: Raento, Mika; Korpioaho, Kalle; Juhala, Jaripekka; Kujala, Teija

Schedule: 2002-01-01 ... 2005-12-31

Co-operation units: Nokia Research Center

Keywords: Context recognition, sensor data

The project concentrates on designing on-line clustering methods for sensor data in mobile devices. The results include very efficient and accurate on-line clustering methods for moderately high-dimensional data. The project is funded by Nokia Research Center.

4.2.1.4 Networking and Architecture for Proactive Systems (NAPS) – Algorithms and Protocols

Project leader: Floréen, Patrik

Research group: Adaptive Computing Systems

Researchers: Floréen, Patrik; Orponen, Pekka (HUT); Kohonen, Jukka; Ukkonen, Johannes; Kaski, Petteri (HUT); Autere, Antti (HUT); Falck, Emil (HUT)

Schedule: 2003-01-01 ... 2005-12-31

Co-operation units: Laboratory for Theoretical Computer Science and Networking Laboratory, Helsinki University of Technology

Keywords: Ad hoc networking, algorithms

Research program: Proactive Computing (PROACT), Academy of Finland

The network computing and communication models underlying proactive applications give rise to new opportunities and challenges in the fields of algorithm design and analysis. The project approaches, among others, multiobjective optimization problems in topology control and hierarchical routing of ad hoc networks by the well-established methods of systematic design and analysis of algorithms, specifically approximative and randomized techniques applied in the context of distributed online computational problems.

4.2.2 Data Analysis

The developments in measurement and data collection technologies have made it possible to gather and store large amounts of information in many areas of science and industry. The ability to analyze these masses of raw data has increased at a much slower speed, however. The HIIT Basic Research Unit research program on data analysis develops data mining and computational statistics methods for various application tasks.

4.2.2.1 Data Mining

Project leader: Heikki Mannila

Research group: Data analysis

Researchers: Toivonen, Hannu; Salmenkivi, Marko; Geerts, Floris; Terzi, Evimaria; Jaeger, Manfred; Bingham, Ella; Seppänen, Jouni; Leino, Antti

Schedule: 2002-01-01 ...

Co-operation units: University of California at Irvine, Nokia Research Center, Max-Planck Institute for Informatik

Publications: 1, 2, 6, 15, 16, 17, 19, 24, 25, 38, 39, 40, 41, 58, 59, 60, 81, 82, 83

Keywords: Data mining, algorithms

The project develops methods and tools for analyzing large data sets and for searching for unexpected relationships in the data. The project combines development of combinatorial pattern-matching algorithms with statistical techniques and database methods. The resulting techniques typically search through a large collection of potential local models that describe some aspect of the data in an easily understandable way. The project has also studied the construction of efficient predictors from large masses of data.

The group has produced several important results in methods for finding association rules, episode rules, and similarities from relational databases, event sequence data, and text. The methods have so far been applied in telecommunications, paleoecology, medical genetics and text databases. The data-mining research has lots of industrial applications, and part of the research group works currently in industry.

One of the major goals for the next years is further integration of combinatorial and statistical techniques. The project has had good success in, e.g., approximating joint distributions by using association rules and maximum entropy principles. Similar combination techniques can profitably be used elsewhere, too: for example, ensemble methods in combination with association and episode rules can produce simple but powerful predictors. Another goal of the project is novel methods for analyzing spatial and spatiotemporal data arising in telecommunications and biological applications.

4.2.2.2 Computational Methods for Genome Structure and Gene Mapping

Project leader: Hannu Toivonen

Research group: Data analysis

Researchers: Sevon, Petteri; Onkamo, Päivi; Mannila, Heikki; Vasko, Kari; Ollikainen, Vesa; Geerts, Floris

Schedule: 2002-01-01 ...

Co-operation units: KTL – National Public Health Institute, Department of Medical Genetics (UH), Karolinska Institute

Publications: 3, 7, 8, 12, 14, 30

Keywords: Gene mapping, genome structure, probabilistic methods

Locating genes that predispose to diseases is highly important in understanding the etiology of complex common diseases, such as heart disease, or asthma. For association analysis, the sample of patients, controls, and their relatives is genotyped and haplotyped, i.e. the two alleles at each marker locus in each individual are ordered according to parental origin. Then, alleles and short strings of alleles of nearby (consecutive) markers correlating with the patient-control status are searched by means of association methods. The aim is to pinpoint the location of the disease susceptibility (DS) mutation as accurately as possible.

Research on linkage disequilibrium-based gene-mapping methods for complex diseases has been continued on three fronts: reconstruction and use of plausible gene genealogies in gene mapping, mapping of quantitative traits, and mapping from genotype data. In particular, we generalized our haplotype pattern based gene-mapping method HPM to work with both quantitative traits and covariates [14]. These extensions significantly widen the scope of the haplotype pattern based approach. The scope is being extended to genotype data, too: many methods assume haplotype data, whereas genotypes are often all that is available. The haplotype pattern based approach can be applied on genotype data, and the first experiments are promising.

Research topics for 2003

- Association analysis from haplotype data, genotype data and pooled DNA data.
- Haplotyping from population-based genotype data and from pooled DNA data.
- Defining and utilising haplotype block structure of the human genome.
- SNP tagging, i.e. optimal marker selection.
- Oligogenic models for binary traits, in particular, Bayesian inference using recurrence risk data and Markov chain Monte Carlo (MCMC) simulation methods.
- Segment structure in isolated subpopulations.

4.2.2.3 Data Analysis for Functional Genomics

Project leader: Jaakko Hollmén

Research group: Data analysis

Researchers: Patrikainen, Anne; Ruosaari, Salla; Seppänen, Jouni

Schedule: 2002-01-01 ...

Co-operation units: KTL – National Public Health Institute, Department of Medical Genetics (UH), Karolinska Institute

Publications: 5, 13, 53

Keywords: Gene mapping, genome structure, probabilistic methods

The group develops data analysis methods for analyzing gene-related data, such as gene expression data for revealing their function.

With the advent of microarrays, it is possible to obtain large amounts of data about the genes' expression - the transcriptional activity of genes in an organism. Whereas thousands of genes are measured at one time, only a few samples are usually measured due to cost constraints and the limited availability of tissue samples in a specific research scope.

Gene expression data analysis aims at revealing the specific roles played by genes in the experimental situation. Usually, the setting is to compare the gene expression profiles between healthy and sick patients. Currently, the research focus is shifting towards data analysis of microarray data in conjunction with other sources of data or in more complicated combinations. For instance, the subject (patient) may have other clinical data. Also, the genes have additional attributes such as chromosomal location and maybe known relations to other genes. The repeated measurements from a sample under treatment form a time-series, which can be helpful in investigating the temporal development of gene expression. Ultimately, the data analysis helps in creating knowledge needed for developing prognostic and diagnostic tools, which are valuable in the clinical setting.

5 Researcher Training and Research Visits

5.1 Doctoral Degrees Earned by HIIT Personnel

16.8.2002: Vesa Ollikainen, *Simulation Techniques for Disease Gene Localization in Isolated Populations*, University of Helsinki, supervisor Professor Heikki Mannila.

29.11.2002: Jan Blom, *Psychological Implications of Personalised User Interfaces*, Department of Psychology, University of York, supervisor Professor Andrew Monk.

9.12.2002: Anu Kankainen, *Thinking Model and Tools for Understanding User Experience Related to Information Appliance Product Concepts*, Helsinki University of Technology, supervisor Professor Martti Mäntylä.

5.2 Post-graduate Courses Arranged by HIIT

Spring 2002 Energy-aware computation (Heikki Mannila, Pekka Orponen)

Spring 2002 Special topics in bioinformatics (Jaakko Hollmén, Harriet Wikman)

Spring 2002 Information extraction (Greger Lindén)

June 2002 The Second HIIT-UCB Summer School, University of California at Berkeley (Kimmo Raatikainen, Randy Katz)

June 2002 Advanced algorithms in data mining (Heikki Mannila)

Autumn 2002 Seminar on gene mapping methods (Mikko Koivisto)

Autumn 2002 Proactive computing (Greger Lindén, Kari Laasonen)

Autumn 2002 Research seminar on algorithmics (Patrik Floréen)

Nov 2002 Computational methods in gene mapping and genome structure (Heikki Mannila)

Nov 2002 XML Basics (Mika Raento)

5.3 Visits to HIIT

Manfred Jaeger, PhD, Max-Planck-Institut für Informatik, Saarbrücken, Germany (4.3.-28.5. and 11.11.-20.12.2002)

Luc De Raedt, PhD, Professor, Albert-Ludwigs-Universität, Freiburg, Germany (7.-15.3.2002)

Magnus Halldorsson, PhD, Professor, University of Iceland (5.-10.11.2002)

Aristides Gionis, PhD student, Stanford University, USA (24.8.-7.10.2002)

Phillip Rogaway, Professor, University of California at Davis, USA (21.-28.4.2002)

Myra Spiliopoulou, Professor, Institut für Wirtschaftsinformatik, Humboldt-Universität zu Berlin, Germany (December 2002)

5.4 Visits from HIIT

Pekka Himanen, PhD., Berkeley Center for the Information Society, International Computer Science Institute, USA (several visits during 2002).

Martti Mäntylä, Professor, School of Information Management and Systems, University of California at Berkeley, USA (3.–12.6. and 24.9.–2.10.2002).

Ville Oksanen, PhD student, School of Information Management and Systems, University of California at Berkeley, USA (1.1.–13.12.2002).

Antti Oulasvirta, PhD student, Center for Cognitive Science, University of California at Berkeley, USA (15.9.2002–).

Kimmo Raatikainen, Professor, Department of Computer Science, University of California at Berkeley, USA (Sahara Retreats in January and June 2002).

Kimmo Raatikainen, Professor, University of Canterbury, Christchurch, New Zealand (8.7.–12.9.2002).

Risto Sarvas, PhD student, School of Information Management and Systems, University of California at Berkeley, USA (15.8.2002–).

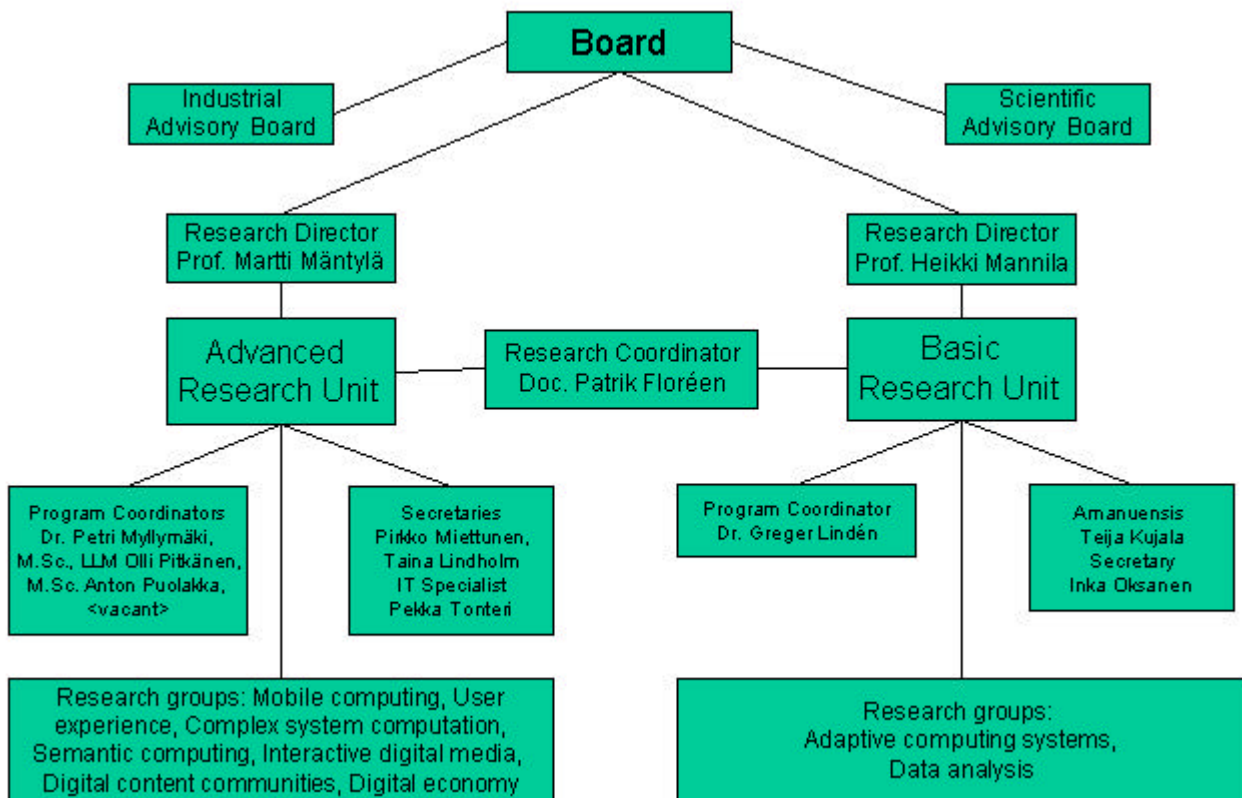
Henry Tirri, Professor, Department of Computer Science, Stanford University, USA (several visits during 2002).

6 Administration

6.1 Overview

Year 2002 was marked by a considerable change in the administrative structure of HIIT. The Basic Research Unit launched its operation, and its existence was formally recognised in the new management bylaws of HIIT that were ratified by the University of Helsinki (UH) and the Helsinki University of Technology (HUT) in June 2002.

After these changes, HIIT is now firmly established as a joint research centre of the two universities that consists of two units, the Advanced Research Unit (ARU) and the Basic Research Unit (BRU). ARU receives its administrative services from HUT. This includes that ARU researchers are formally employees of HUT; that financial services of ARU are provided by HUT; and that the Research Director and other personnel of ARU are appointed according to the practices observed at HUT. Similarly and symmetrically, BRU is administratively associated with the University of Helsinki and follows its administrative rules and processes. The resulting structure is shown in the organisation chart below.



As shown, the two units share a number of administrative units. These include the Board of the research institute and the Scientific and Industrial Advisory Boards. Furthermore, the Research

Coordinator Dr. Patrik Floréen is jointly affiliated with both units, and indeed one of his missions is to facilitate their co-operation.

As seen in Section 5 of this report, both ARU and BRU operate in practise at both parent universities and has joint research projects, as might be expected from a joint research centre. Thus the administrative structure is just that – it does not signify an operational division.

6.2 Board

According to the bylaws, the Board of HIIT consists of nine full members. Both parent universities nominate two members from the academic community and two members from industrial companies. The ninth member is elected by the research personnel associated with HIIT. Each member has a personal deputy. Only the full members have a vote in the meetings.

The present full members of the Board and their personal deputies are as follows:

<i>Member</i>	<i>Personal deputy</i>
Vice Rector, Professor Mauri Airila, HUT	Vice Rector, Professor Matti Pursula, HUT
Professor Olli Simula, HUT	Professor Markku Syrjänen, HUT
Vice Rector, Professor Thomas Wilhelmsson, UH	Vice Rector, Professor Raija Sollamo, UH
Academy Professor Esko Ukkonen, UH	Professor Jukka Paakki, UH
Rolf Svanbäck, Ericsson	Markku Korpi or Stefan von Schanz, Ericsson
	<i>From 8/2002:</i> Raimo Vuopionperä, Ericsson
Aimo Maanavilja, Elisa Communications	Pertti Hölttä, Elisa Communications
	<i>From 8/2002:</i> Minttu Lintera, Elisa Communications
Veikko Hara, Sonera	Juha Aaltonen, Sonera
Heikki Saikkonen, Nokia	Harry Herlin, Nokia
Petri Myllymäki, HIIT	Yki Kortensniemi, HIIT

In addition, the Board has invited further industry representatives from industrial companies that work closely with HIIT. These invited members can also nominate personal deputies. During 2002, the invited industry members of the Board were as follows:

<i>Invited member</i>	<i>Personal deputy</i>
Anneli Rantanen, TietoEnator	Olli Lötjönen, TietoEnator
Raimo Mäkilä, Alma Media	Pirjo Tiainen or Osmo Koskisto, Alma Media
<i>From 8/2002:</i> Marko Turpeinen, Alma Media	<i>From 8/2002:</i> Seppo Vanhatalo, Alma Media
Eskoensio Pipatti, Sanoma-WSOY	
Juha Vesaoja, Yleisradio	Kalevi Rantala, Yleisradio
Pia Sarnala-Kallio, Nordea	Juha Toivari, Nordea

Furthermore, the two Research Directors attend the meetings and are responsible for preparing and presenting any decision items. The Research Coordinator and Program Coordinators of both units also have the right to attend the meetings. During 2002, these expert members were as follows:

Expert member

Research Director Martti Mäntylä, HIIT ARU

Research Director Heikki Mannila, HIIT BRU

Research Coordinator Patrik Floréen, HIIT ARU & BRU

Program Coordinator Olli Pitkänen, HIIT ARU

Program Coordinator Anton Puolakka, HIIT ARU

Secretary Pirkko Miettunen, HIIT ARU

During 2002, the Board had five meetings. A brief summary of their main contents follows.

- 12.2.2002 First presentation of the ARU budget of 2002. Decision of Rector of HUT on the administrative practises related to UH professors acting as responsible project managers at ARU. Discussion on the composition of the Scientific Advisory Board. First discussion of planned senior position responsible for international research. Setting up a committee to prepare the new bylaws for HIIT.
- 9.4.2002 Progress report on the negotiations between HIIT and companies on project contracts to be used in HIIT projects. Presentation of the draft bylaws: the Board agreed to submit them to both universities for ratification. Proposal on senior research positions to be founded in HIIT.
- 13.6.2002 Further discussion on ARU budget. Report on project contract negotiations. Appointment of Dr. Patrik Floréen as the Research Coordinator.
- 30.8.2002 Final acceptance of the ARU budget on the basis of negotiations between the ARU Research Director and the Rector of HUT. Report on project contract negotiations.
- 5.11.2002 First presentations on the 2003 plans of both units. The board ratified the research contract template for "business critical" projects and also the contract templates for use with researchers and with the UCB. Discussion on the results of the financial audit undertaken in ARU.

As can be seen, prominent topics of the year included the ARU budget, the project contract templates, and various plans on the expansion of HIIT's senior researcher positions that finally materialised in the appointment of the joint Research Coordinator for ARU and BRU.

6.3 Scientific Advisory Board

In April 2002, the Board of HIIT agreed to invite the following prominent scientists to the Scientific Advisory Board of HIIT:

- Dr. Ross Anderson, University of Cambridge
- Professor Alberto Apostolico, Purdue University
- Professor Richard Buxbaum, University of California at Berkeley

- Professor Christos Faloutsos, Carnegie Mellon University
- Professor Randy Katz, University of California at Berkeley
- Professor Bengt Jonsson, Uppsala University
- Professor Martin Kersten, University of Amsterdam and CWI (National Research Institute for Mathematics and Computer Science in the Netherlands)
- Professor Kari-Jouko Rähkä, University of Tampere
- Professor Mart Saarma, University of Helsinki
- Professor John Shawe-Taylor, Royal Holloway, University of London
- Professor Hal Varian, University of California at Berkeley
- Dr. Martin Vingron, Director, Max Planck Institute for Molecular Genetics

The above members have agreed on the invitation. The first actual meeting of the SAB is planned to take place in October 2003.

6.4 Industrial Advisory Board

The Industrial Advisory Board is invited by the Board from representatives of companies in close co-operation with HIIT. The present members are as follows:

<i>Company</i>	<i>Representative</i>	<i>Deputy</i>
Sonera	Veikko Hara (chair)	Juha Aaltonen
Elisa Communications	Aimo Maanavilja	Pertti Hölttä
Nokia	Heikki Saikkonen	Harry Herlin
Ericsson	Raimo Vuopionperä	Aarre Kilpinen
Sanoma-WSOY	Pekka Jaakola	Eskoensio Pipatti
Alma Media	Raimo Mäkilä	Mikko Räisänen
Yleisradio	Juha Vesaoja	Kalevi Rantala
TietoEnator	Anneli E. Rantanen	Jyrki Poteri/Mikko Rauko
Nordea	Pia Sarnala-Kallio	Juha Toivari

The IAB had only one meeting in 2002: it had been judged that while the research contracts were being negotiated, the IAB could not have made much progress. The meeting discussed the role of the IAB in light of the new bylaws, the procedure for inviting new members to the IAB, HIIT's interface with the industry, and HIIT's longer-term plans.

6.5 Internal ARU Administration

The administrative resources and processes of ARU were developed further during 2002, but continued to be very light.

The administrative personnel is listed in the table below, with their main responsibilities. Observe that all coordinators only allocate a small part of their resources to administrative tasks; they all are primarily researchers.

<i>Person</i>	<i>Percentage of administrative load</i>	<i>Main responsibility areas</i>
Research Director Martti Mäntylä	100%	General management, budgeting and planning, external relations, <i>etc.</i>
Research Coordinator Patrik Floréen	40%	International research, particularly EU research
Program Coordinator Petri Myllymäki	20%	Administration of the Intelligent Systems research area
Program Coordinator Olli Pitkänen	30%	Administration of the Digital Economy research area; research contract negotiations and other IPR issues
Program Coordinator Anton Puolakka	40%	Administration of the Media Convergence research area; misc. administrative tasks
Institute Secretary Pirkko Miettunen	100%	Personnel administration and financial administration for all research areas except Intelligent Systems; secretary to the Board
Project Secretary Taina Lindholm	100%	Personnel administration and financial administration for the Intelligent Systems research area; misc. secretarial services
IT Specialist Pekka Tonteri	100%	Administration and planning of IT services at HTC

To facilitate the proper processing of administrative tasks, and also to improve the flow of information between various research groups in ARU, an internal Administrative Board was launched in 2002. Its members include the administrative personnel listed above, and also the heads of the research groups involved in ARU's work (Professors Henry Tirri, Kimmo Raatikainen, Eero Hyvönen, Timo Soininen; Dr. Jukka Kemppinen). The Administrative Board had 14 meetings during the year.

Between the Admin Board meetings, the research director and the coordinators had coordination meetings almost weekly.

As the meetings of the Administrative Board mainly consider short-term tasks and duties, another internal organ for longer-term planning and discussion amongst senior research personnel was launched experimentally with three meetings during the fall 2002. The members of this "Strategy Board" include the research director, all senior researchers involved in ARU projects, and the coordinators.

6.6 Internal BRU Administration

The BRU administrative structure is very light, as the unit can use the services of the departments of computer science of the Helsinki University of Technology and the University of Helsinki. Heikki Mannila is in overall charge of the unit's general management, budgeting, and planning. The administrative personnel consists of Planning Secretary Inka Oksanen, responsible for personnel,

budgeting, events, and miscellaneous secretarial tasks, and Amanuensis Teija Kujala, who participates in administration for about 50 % of her total work time.

6.7 Personnel

Apart from personnel directly employed by HIIT's two units – for ARU, as HUT employees and for BRU, as UH employees – quite a few persons also work in both units with some other form of funding, such as post-graduate student scholarships from the joint UH-HUT Helsinki Graduate School of Computer Science and Engineering HeCSE or various academic positions from Research Associate to Full Professor. HIIT also embodies a few people assigned to HIIT by companies that continue to pay their salary. In addition, many HIITites have double affiliations and share their time between HIIT and some other organisation.

For ARU, the number of full-time person equivalents in 2002 was 40 person-years, compared to 24 in 2001. While demonstrating the growth that took place during 2002, this only measures the number of people hired directly by ARU in administrative positions or in research activities. The actual number of people affiliated with ARU by the end of 2002 was close to 80.

For BRU, the number of persons affiliated to the unit at the end of 2002 was about 25.

A full list of people having worked in HIIT/ARU and BRU projects during 2002, independent of where their salaries came from, is given in Appendix A. In this list, we have chosen to list also part-time HIIT employees. The list has close to 120 names.

7 Funding and Costs

7.1 ARU Finances

The official bookkeeping for ARU is maintained by Helsinki University of Technology that also publishes the official financial results of the unit. Nevertheless, for historical reasons, the bookkeeping of the DeepC project is maintained at the University of Helsinki. The following table is based on HUT bookkeeping with the contribution of DeepC added. It gives the data for 2002 and also for the earlier years of HIIT's existence.

	1999	2000	2001	2002
Total funding	95 026 €	593 910 €	1 991 976 €	2 935 842 €
HUT funding	47 513 €	185 582 €	258 874 €	258 188 €
UH funding	47 513 €	95 740 €	240 636 €	188 188 €
Academy of Finland			15 137 €	99 996 €
National Technology Agency TEKES		244 729 €	947 062 €	1 644 796 €
Industrial partners		67 859 €	508 403 €	643 724 €
Ministries and other public funding			21 864 €	100 950 €
Total expenses	30 118 €	552 274 €	1 988 033 €	3 031 878 €
Salaries	7 667 €	255 502 €	931 408 €	1 730 156 €
Other operational expenses	22 115 €	210 541 €	652 829 €	586 327 €
Rents	336 €	5 878 €	217 616 €	476 895 €
Service charge to HUT		80 353 €	186 180 €	238 500 €
Balance	64 908 €	41 636 €	3 943 €	-96 036 €
Cumulative balance	64 908 €	106 544 €	110 487 €	14 450 €
University funding % of total funding	100 %	47 %	25 %	15 %
External funding % of total funding	0 %	53 %	75 %	85 %
- of which Academy funding	0 %	0 %	1 %	3 %
- of which TEKES funding	0 %	41 %	48 %	56 %
- of which industrial funding	0 %	11 %	26 %	22 %
- of which other public funding	0 %	0 %	1 %	3 %
Salaries % of total expenses	25 %	46 %	47 %	57 %
Other expenses % of total expenses	73 %	38 %	33 %	19 %
Rents % of total expenses	1 %	1 %	11 %	16 %

The table shows the actual use of the allocated university funding. In particular, a sizable part of the year 2000 funding was actually spent in 2001, which explains the indicated growth of university funding in 2001.

The year 2002 was financially tough for the ARU, mainly because the full burden of the rents for the new HTC premises was encountered for the first time. Therefore, in August 2002 ARU negotiated a new financing agreement with the rectors of the parent universities. According to the agreement, the ARU received additional funding allocations from HUT (90,000 €) and UH (20,000 €), and was

permitted to run a maximal negative balance of 100,000 € by the end of 2002. As shown, this was offset by the surplus earned during previous years.

More importantly, the agreement also covered financing for the years 2003 and 2004. Also, ARU's rents from 2003 onwards will be some 140,000 € lower than in 2002. With this, ARU's financing in the future is likely to be in balance with the expenses.

7.2 BRU Finances

The funding structure of BRU differs considerably from that of ARU.

BRU's funding consists of basic funding provided in 2002 by the University of Helsinki, and project funding obtained for each project individually from the Academy of Finland, industry, etc. The finances of the basic funding are handled through the Department of Computer Science of the University of Helsinki, and the finances of the projects are handled through the department that has the main responsibility for the project.

As several projects had been started before 2002 and the personnel was partly within BRU and partly outside, there is no unambiguous way of allocating which part of the total project funding was spent on BRU. The following numbers have been obtained by taking the themes of the projects into account.

Basic funding	538 000 €	49 %
Academy of Finland		23 %
Life 2000	75 000 €	
ProAct Programme Coordination	94 000 €	
Data analysis	84 000 €	
Industrial projects	99 000 €	9 %
Graduate schools	210 000 €	19 %
Total	1 100 000 €	100 %

BRU has no fixed costs (rents, etc.). The basic funding was used mainly for salaries and side costs; year 2002 also included a considerable investment (80,000 €) into equipment.

Appendices

A Personnel

Aho, Laura Helena	Project Secretary	ARU	1.6. - 30.6.2002
Asikainen, Timo	Researcher	ARU/TAI	1.1. – 31.12.2002
Airaksinen, Jukka	Researcher	ARU	1.3. - 30.11.2002
Bingham, Ella	Researcher	BRU	1.3. - 30.11.2002
Blom, Jan	Researcher	ARU	15.8. – 31.12.2002
Buntine, Wray	Senior Research Scientist	ARU	15.2. – 31.12.2002
Eronen, Lauri	Assistant Researcher	BRU	1.6. - 31.12.2002
Floréen, Patrik	Research Coordinator	ARU/BRU	1.8. - 31.12.2002
Geerts, Floris	Researcher	BRU	1.9. - 31.12.2002
Guo, Heng	Research Assistant	ARU	1.1. - 31.10.2002
Hakulinen, Sampsa	Researcher	ARU	1.6. - 30.9.2002
Hasu, Tero	Researcher	ARU	15.4 - 21.4.2002
Heikkilä, Juho	Research Assistant	ARU	1.1. - 31.12.2002
Hietanen, Herkko	Research Assistant	ARU	1.8. - 31.12.2002
Himanen, Pekka	Research Scientist	ARU	15.2. – 31.12.2002
Hintsanen, Petteri	Assistant Researcher	BRU	6.5. - 31.12.2002
Hohti, Marja	Researcher	ARU	1.3. - 30.11.2002
Hollmén, Jaakko	Senior Research Scientist	BRU	1.1. - 31.12.2002
Honkala, Mikko	Project Manager	ARU	1.1. - 31.12.2002
Hyvönen, Eero	Principal Scientist	ARU	1.1. - 31.12.2002
Hyvönen, Saara	Researcher	BRU	1.8. - 31.12.2002
Juhala, Jari-Pekka	Assistant Researcher	BRU	20.5. - 20.9.2002
Kalliokoski, Matti	Project Manager	ARU	1.1. - 31.12.2002
Kanerva, Pekka	Researcher	ARU	1.1. - 31.12.2002
Kangasharju, Jaakko	Researcher	ARU	1.2. - 31.12.2002
Kankainen, Anu	Researcher	ARU	1.1. - 31.12.2002
Kankainen, Tomi	Project Manager	ARU	1.1. - 31.12.2002
Karvonen, Kristiina	Researcher	ARU	1.3. - 31.7.2002

Kautto, Vesa	Researcher	ARU	1.1. - 31.5.2002
Kemppinen, Jukka	Principal Scientist	ARU	1.1. - 31.12.2002
Kettula, Suvi-Päivikki	Researcher	ARU	1.4. - 31.12.2002
Kiiskinen, Miika	Research Assistant	ARU	1.1. - 30.9.2002
Kojo, Tero	Researcher	ARU/TAI	1.1. – 31.12.2002
Komu, Miika	Research Assistant	ARU	1.6. - 31.12.2002
Kontiainen, Mikko	Researcher	ARU	1.7. - 31.12.2002
Kontkanen, Petri	Researcher	ARU	1.1. – 31.12.2002
Korpiaho, Kalle	Assistant Researcher	BRU	20.5. - 20.9.2002
Kortesniemi, Yki	Project Manager	ARU	1.1. - 31.12.2002
Kousa, Mika	Research Assistant	ARU	1.6. - 31.12.2002
Kujala, Teija	Amanuensis	BRU	1.8. - 31.12.2002
Kurvinen, Esko	Researcher	ARU	1.1. - 31.5.2002
Laasonen, Kari	Researcher	BRU	1.1. - 31.12.2002
Lahtinen, Jussi	Researcher	ARU	1.1. - 30.9.2002
Latva-Koivisto, Antti	Researcher	ARU	1.1. - 28.2.2002, 1.7. - 31.8.2002
Leino, Antti	Researcher	BRU	15.4. - 31.12.2002
Lepola, Tuomas	Researcher	ARU	1.1. - 31.7.2002
Lindén, Greger	Research Coordinator	BRU	1.1. - 31.12.2002
Lindholm, Tancred	Researcher	ARU	1.4. - 31.12.2002
Lindholm, Taina	Project Secretary	ARU	1.1. - 31.12.2002
Löfström, Jaakko	Research Assistant	ARU	1.9. – 31.12.2002
Mannila, Heikki	Director of Research	BRU	1.1. - 31.12.2002
Miettinen, Miikka	Researcher	ARU	1.1. - 31.12.2002
Miettunen, Pirkko	Secretary	ARU	1.1. - 31.12.2002
Misikangas, Pauli	Researcher	ARU	1.1. – 31.12.2002
Mononen, Tommi	Researcher	ARU	1.1. – 31.12.2002
Multimäki, Mikko	Researcher	ARU/TAI	1.1. – 31.12.2002
Myllymäki, Petri	Academy Research Fellow	ARU	1.1. – 31.12.2002
Mäkelä, Mikko	Program Coordinator Research Assistant	ARU ARU	1.1. - 30.9.2002, 1.10. - 31.12.2002
Männistö, Tomi	Project Manager	ARU/TAI	1.1. – 31.12.2002

Mäntylä, Martti	Director of Research	ARU	1.1. - 31.12.2002
Nikander, Pekka	Ericsson Visiting Senior Research Scientist	ARU	1.1. – 31.12.2002
Nokelainen, Petri	Researcher	ARU	1.1. - 31.10.2002
Nurminen, Antti	Project Manager	ARU	1.1. - 31.12.2002
Ojanpää, Samu	Researcher	ARU	1.1. – 31.12.2002
Oksanen, Inka	Project Assistant	BRU	7.1. - 31.12.2002
Oksanen, Ville	Researcher	ARU	1.1. - 31.12.2002
Ollikainen, Vesa	Researcher	BRU	1.1. - 31.12.2002
Oraskari, Jyrki	Research Assistant	ARU	1.1. - 6.6.2002
Onkamo, Päivi	Researcher	BRU	28.10. - 31.12.2002
Oulasvirta, Antti	Research Assistant Researcher	ARU ARU	1.1. - 31.7.2002, 1.8. - 31.12.2002
Parhankangas, Juha	Research Assistant	ARU	1.1. - 31.12.2002
Patrikainen, Anne	Researcher	BRU	1.1. - 31.12.2002
Pennala, Eero-Heikki	Technical Assistant	ARU	1.6. - 14.7.2002
Perttu, Sami	Researcher	ARU	1.2. - 31.12.2002
Pitkänen, Olli	Program Coordinator	ARU	1.1. - 31.12.2002
Puolakka, Anton	Program Coordinator	ARU	1.3. - 31.12.2002
Päiväniemi, Tomi	Researcher	ARU	1.1. – 31.12.2002
Raatikainen, Kimmo	Principal Scientist	ARU	1.1. - 31.12.2002
Raatikainen, Mikko	Researcher	ARU/TAI	1.1. – 31.12.2002
Raatikka, Vilho	Research Assistant	ARU	1.4. - 31.12.2002
Raento, Mika	Researcher	BRU	9.9. - 31.12.2002
Rantanen, Matti	Research Assistant Researcher	ARU ARU	1.1. - 31.8.2002, 1.9. - 31.12.2002
Rauhala, Esa	Research Assistant	ARU	1.1. – 31.5.2002
Reti, Tommo	Researcher	ARU	1.1. - 31.12.2002
Rimey, Kenneth	Senior Research Scientist	ARU	6.5. - 31.12.2002
Rissanen, Jorma	HIIT Fellow	ARU	1.1. – 31.12.2002
Roos, Teemu	Researcher	ARU	1.1. - 31.12.2002
Ruosaari, Salla	Researcher	BRU	1.1. - 31.12.2002
Saarela, Samppa	Research Assistant	ARU	1.10. - 31.12.2002

Saaresto, Marko	Research Assistant	ARU	16.9. - 31.12.2002
Saijos, Jani	Assistant Researcher	BRU	20.5. - 31.12.2002
Samarin, Michael	Researcher	ARU	1.1. – 31.12.2002
Santala, Jukka	Research Assistant	ARU	1.9. - 31.12.2002
Sarvas, Risto	Researcher	ARU	1.1. - 31.12.2002
Seppänen, Jouni	Researcher	BRU	1.1. - 31.12.2002
Silander, Tomi	Researcher	ARU	1.1. – 31.12.2002
Simojoki, Samuli	Project Manager	ARU	1.1. - 31.12.2002
Sivaraman, Ganesh	Researcher	ARU	1.1. - 31.12.2002
Soininen, Aura	Research Assistant Researcher	ARU ARU	1.1. - 30.6.2002, 1.7. - 31.12.2002
Soininen, Timo	Senior Researcher	ARU/TAI	1.1. – 31.12.2002
Sulonen, Reijo	Professor	ARU/TAI	1.1. - 31.12.2002
Tarkoma, Sasu	Project Manager	ARU	1.2. - 31.12.2002
Tervo-Pellikka, Raija	Researcher	ARU	1.1. - 31.12.2002
Terzi, Evimaria	Researcher	BRU	19.8. - 31.12.2002
Tiitta, Sauli	Research Assistant Researcher	ARU	1.1. - 30.6.2002, 1.7. - 31.12.2002
Tirri, Henry	Principal Scientist	ARU	1.1. - 31.12.2002
Tonteri, Pekka	IT Manager	ARU	1.1. - 31.12.2002
Tuominen, Antti	Researcher	ARU	1.3. - 31.12.2002
Tuominen, Heikki	Assistant Researcher	BRU	15.5. - 31.12.2002
Turpeinen, Marko	Senior Research Scientist	ARU	1.12. - 31.12.2002
Tuulos, Ville	Research Assistant	ARU	1.8. - 31.12.2002
Valtonen, Kimmo	Researcher	ARU	1.3. - 31.12.2002
Wettig, Johannes	Researcher	ARU	1.2. - 31.12.2002
Vierinen, Juha-Pekka	Research Assistant	ARU	1.1. - 31.12.2002
Viljanen, Kim	Research Assistant	ARU	1.2. - 31.12.2002
Virtanen, Veli Perttu	Project Manager	ARU	1.1. - 31.12.2002
Vuorimaa, Petri	Principal Scientist	ARU	1.1. - 31.12.2002
Välimäki, Mikko	Researcher	ARU	1.1. - 31.12.2002
Ylinen, Katarina	Researcher	ARU/TAI	1.1. – 31.12.2002

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Notifications on invention

117. T. Kankainen, A. Kankainen, A. Oulasvirta, S. Tiitta, A. Nurminen, E. Kurvinen, M. Rantanen, M. Samarin, N. Tatti, P. Kiiskinen: Information Radar.
118. T. Kankainen, A. Kankainen, A. Oulasvirta, S. Tiitta, A. Nurminen, E. Kurvinen, M. Rantanen, M. Samarin, N. Tatti, P. Kiiskinen: Track Detector.